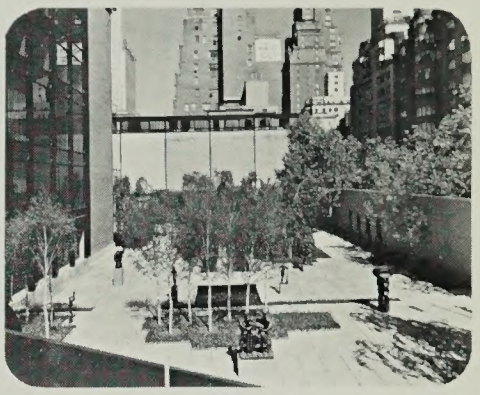
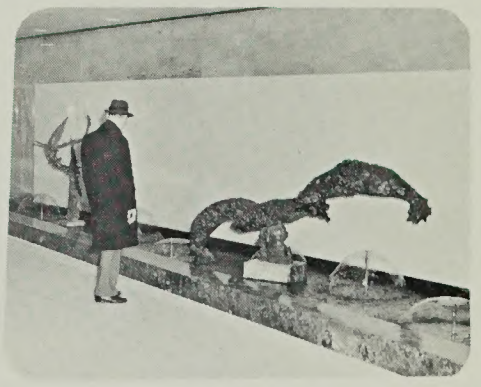
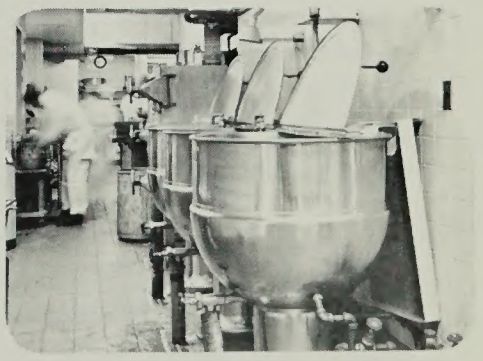
C.S.I. Division 7
A.I.A. FILE NO. 7-A



WATERPROOFING WITH SHEET LEAD





LEAD INDUSTRIES ASSOCIATION, INC.

292 MADISON AVE., NEW YORK

Look Ahead with Lead

C. S. I. Division 7
A.I.A. FILE NO. 7-A

WATERPROOFING

This catalog describes the uses of lead as a membrane waterproofing material for lining pools, planters, fountains, shower stalls and shower rooms, commercial and institutional kitchen floors, soda fountains and bars where positive waterproofing of the highest quality is required. In such installations, sheets of lead as large as can be practically handled are employed and are joined by "burning" (welding) or more rarely by soldering. The lead specified is usually soft sheet lead weighing 4, 6, or 8 lbs per square foot, equivalent to 1/16, 3/32, or 1/8 in., in thickness. The lightest weight is for small and less critical areas such as shower stalls; the heaviest weights are used for larger structures such as reflecting pools and more critical areas where the factor of safety required is of a higher degree.

In almost all installations the membrane is turned up continuously at the walls to form a "pan" and then overlaid with some surfacing or finishing material depending on use. All portions of new concrete slabs or other masonry surfaces over which lead is to be laid shall be covered with asphalt impregnated felt. Where fresh or green cement or concrete is to be placed over lead, the upper surface of lead sheet shall be protected by a heavy brush coat of black asphaltum.

WATERPROOFING WITH LEAD

Whatever the form of construction for a permanent building, whether traditional methods or the most advanced techniques in construction are used, protection against intrusion of water will be required. The general term "waterproofing" however, implies more than just protection against weather since today's building techniques, especially in urban areas, involve total use of land, underground as well as above. This means garage and parking spaces, shops and storage areas, or other income producing areas underground. These must be achieved and executed without prejudice or restriction from above ground installations. Waterproofing is a pressing need when these latter installations include plazas, landscaped areas, grass plots, reflecting pools or plant boxes.

In these uses, sheet lead has proved itself eminently suitable as one of the most practical forms of waterproofing known. Since repairs, replacement and even "normal" maintenance costs on an accessible rooftop installation can be considerable, it stands to reason that if the same were required for a membrane buried beneath complex combinations of fill and finish, landscaping and other features, the costs could be catastrophic. These costs when added to the original costs of which they would certainly be a part, would make lead one of the cheaper means of safely waterproofing valuable occupied areas. Lead sheet, when properly installed, will last as long as the most permanent of buildings.

IMPERVIOUS TO MOISTURE

Lead membranes and pans properly installed provide an impermeable moisture barrier between the unit itself and the adjoining walls and floors, a barrier that is necessary if damage to structures or spaces below is to be avoided. Lead membranes cannot absorb moisture. Such is not the case with non-metallic membranes.

DURABLE

Sheet lead is extremely durable for such applications. Its use as a standard material in chemical plants handling many types of corrosives attests to this fact.

WORKABLE

Sheet lead is extremely workable and can easily be made to conform to the surfaces on which the sheet lead is applied. Thus, voids between the lead and substrates, inherent in more rigid materials, are not left to settle out after the finish is installed.

ADAPTABLE

Sheet lead is extremely adaptable for use in all sizes or shapes. Sheet lead pans are easily and quickly installed for minimum size shower stalls, or in large pools or areas.

COST

The cost of sheet lead is surprisingly low. The basic material cost has leveled off to a point where lead is directly competitive with other quality materials. The ease of working lead reduces costs.

PRECAUTION

Green cement, concrete or mortar containing free lime may be corrosive to lead as it is to many other common metals. It is therefore necessary to coat the lead with asphaltum to protect it during the curing stage of the cement. After the curing, the asphaltum coating which provided the necessary interim protection is no longer important.

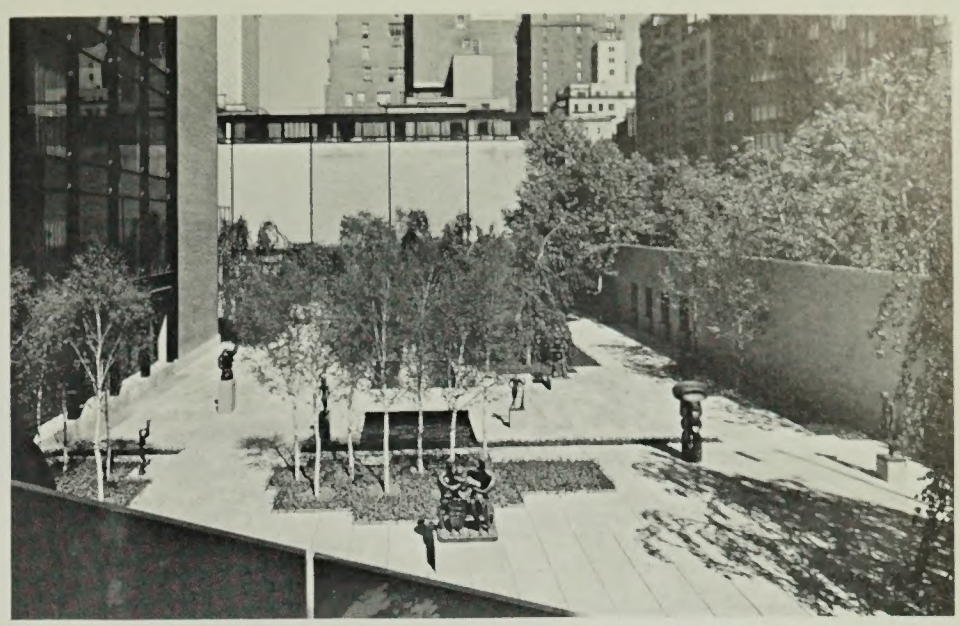
OUTDOOR POOLS AND PLANTERS:

New York Museum of Modern Art

Until a few years ago, opportunities were rare for the architect to provide the proper setting for his building in the form of landscaping. This was especially true in an urban setting. Recently, however, changes in zoning requirements, in setback laws and in building codes have sharply increased the opportunity to include landscaping as part of the total design concept. This has been especially welcome since the surface of a reflecting pool and the presence of trees and grass provide the perfect foil for the rectilinear massing and precise detailing of much of today's architecture.

In order to take full advantage of this opportunity, while losing the minimum of rentable area, all the space under such landscape features is often used. Garage or parking space, display or exhibit areas, shopping centers or merely storage can be provided with assurance of the positive protection a lead membrane will provide.

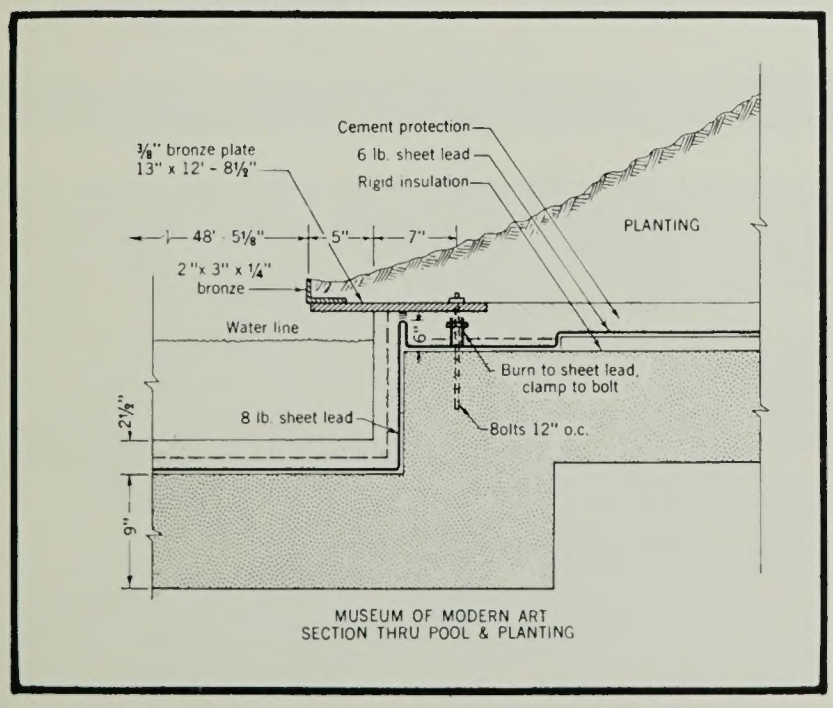
One of the most sophisticated uses of space in this fashion may be found in the Sculpture Garden created by Philip Johnson, Architect, for the Museum of Modern Art in New York City. Several reflecting pools and fountains and a profusion of planting (most of it over gallery or other usable space) is visible in the general view taken from a terrace in the garden. The pool and plant box in the foreground are detailed in the accompanying section. The second section shows the method of waterproofing the spandrel and garden wall at sidewalk level.



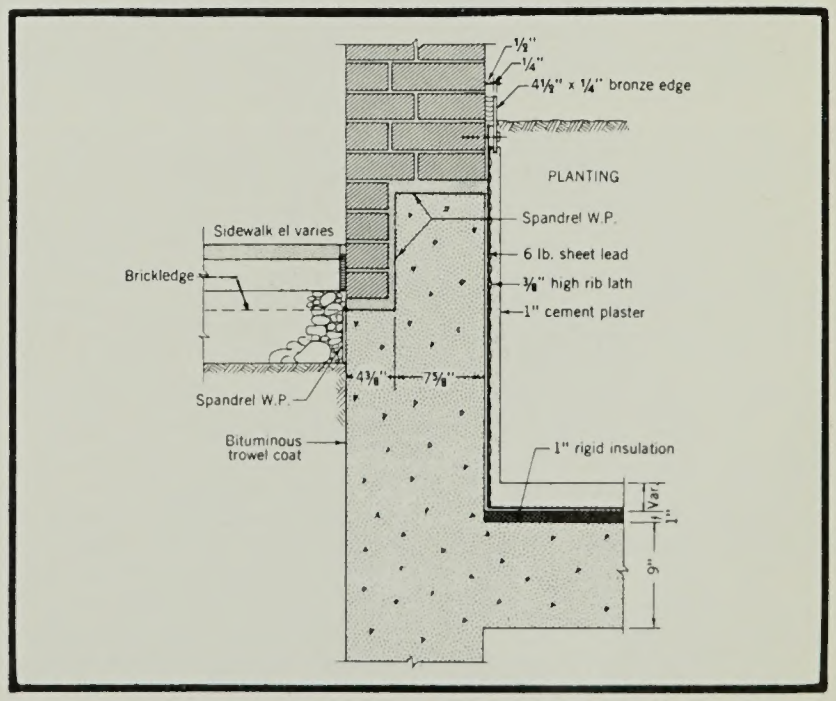
General view of The Abby Aldrich Rockefeller Sculpture Garden in the New York Museum of Modern Art.

Architect: Philip Johnson & Assoc.
General Contractor: Geo. A. Fuller Co.
Landscape Architect: Zion & Breen
Lead Work: John F. Abernethy & Co.

General view of construction work showing sheet lead in place at pool in foreground.



Section through pool and plant box in foreground.



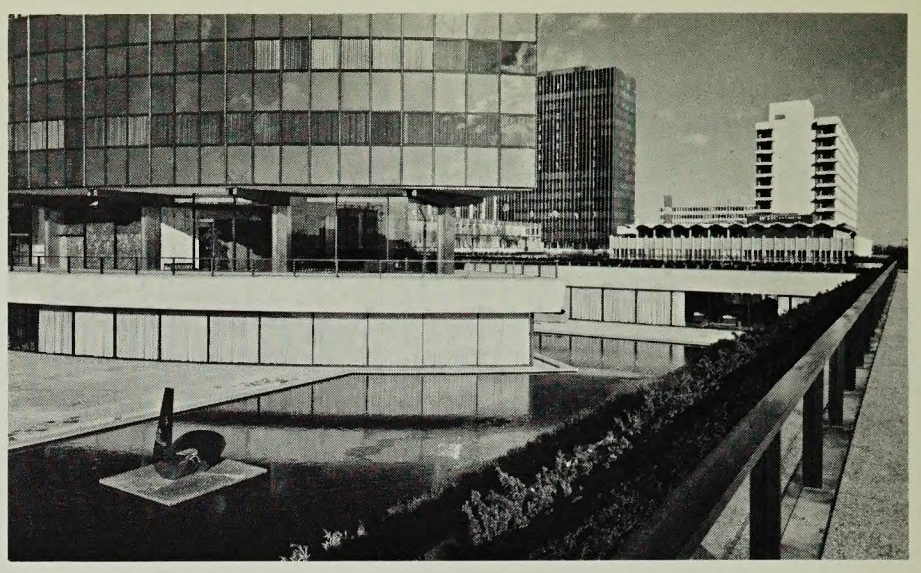
Section through garden wall on street side showing planter waterproofing over occupied space below.

OUTDOOR POOLS AND PLANTERS:

Phoenix Mutual Insurance Company Constitution Plaza Fountain

As a part of Constitution Plaza in Hartford, Connecticut, the Phoenix Mutual Building by Harrison and Abramovitz, Architects, stands partly in its own reflecting pool. The world's first elliptical office tower, it stands on a sloping site which affords opportunity for use of lower levels for mechanical facilities, kitchens, a print shop and two levels of underground parking. The photograph shows how planting has been used in conjunction with the pool. The section through both, details use of 8-lb sheet lead to protect areas below pool level.

Farther to the north on Constitution Plaza is a fine fountain by Charles DuBose, the architect also responsible for site planning of the entire project. A section through the fountain shows the use of 6-lb sheet lead and attachment to an overflow pipe by means of a flashing ring. A parking garage is located below this entire area.



Phoenix Mutual Life Insurance Bldg., Hartford, Connecticut

Reflecting pool and plant box

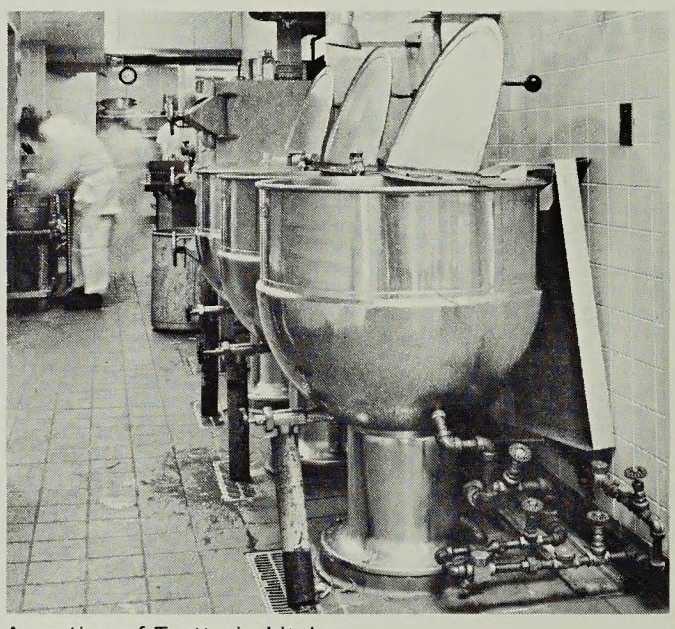
Architect: Harrison & Abramovitz
General Contractor: Geo. A. Fuller
Lead Work: John F. Abernethy

KITCHENS, SODA FOUNTAINS AND BARS:

Pan Am Building's "Trattoria"

Use of prodigious quantities of water and the corrosive effects of acids generated by kitchen activities make a membrane waterproofing essential for the protection of occupied areas below. The kitchen, bar and other sections of three new restaurants in New York City's Pan American Building are good examples of this use. Occupied areas in this case involve the New York Central Railroad whose tracks underlie this particular section of the Grand Central Station area.

The architects in order to meet lobby levels in the building, created a new finished floor elevation above the slab forming the roof over the New York Central property. A section shows the detail of how this was done using low 8-inch masonry supporting walls on which steel decking carries finished floors of terrazzo or quarry tile. Underlying all this construction is 8-lb sheet lead continuous waterproofing, turned up ten inches at surrounding walls. Sheets are lapped one inch and "burned" (welded) after which asphaltum paint over the whole surface provides protection against free lime in fresh mortar or slab concrete. The section is a detail through the bar curbing shown in the photograph. Similar detailing applies to the raised platforms upon which soup kettles and similar kitchen equipment is placed for ease of cleaning and maintenance as shown in the second photo.



A portion of Trattoria kitchen

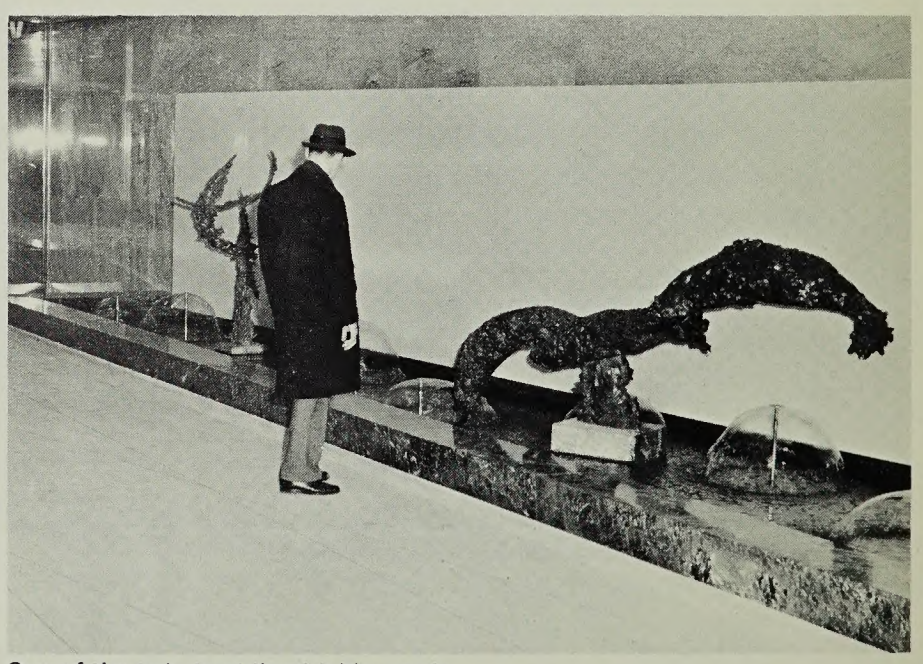
INDOOR POOLS:

1120 Avenue of The Americas, New York

Bringing a pool and fountain indoors no longer presents a problem. These useful and decorative features can be used to enhance the lobby level of business buildings or may be placed on upper floors, setbacks or terraces as desired.

Twin pools in an office building in 1120 Avenue of The Americas in New York, illustrate the use of this device. These pools are mirror images of each other and flank either side of a centrally placed bank of elevators. The constantly changing aspects of bubbling water jets plus modern sculpture against a white marble background lend both distinction and interest.

Eight pound sheet lead was used in this case, all joints were "burned" (welded) and the finished pan was turned up 3 inches above water level. Lead was burned (welded) to brass overflow pipes set into the marble curbing. The function of the lead was protection of a garage at a lower level.

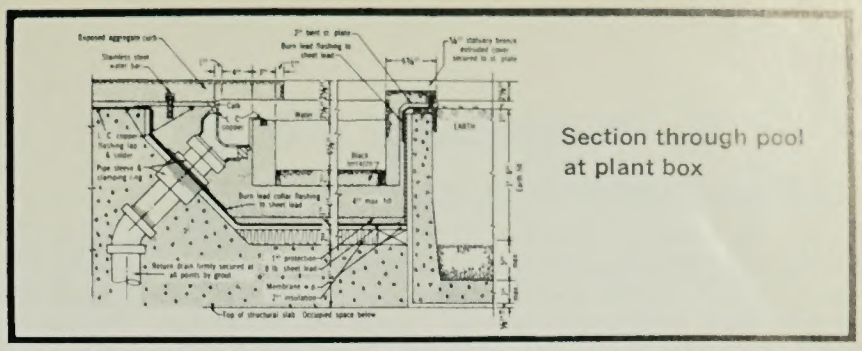


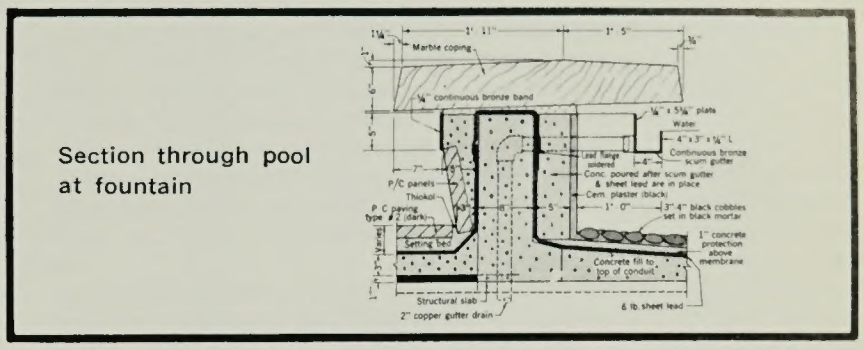
One of the twin lead lined lobby pools

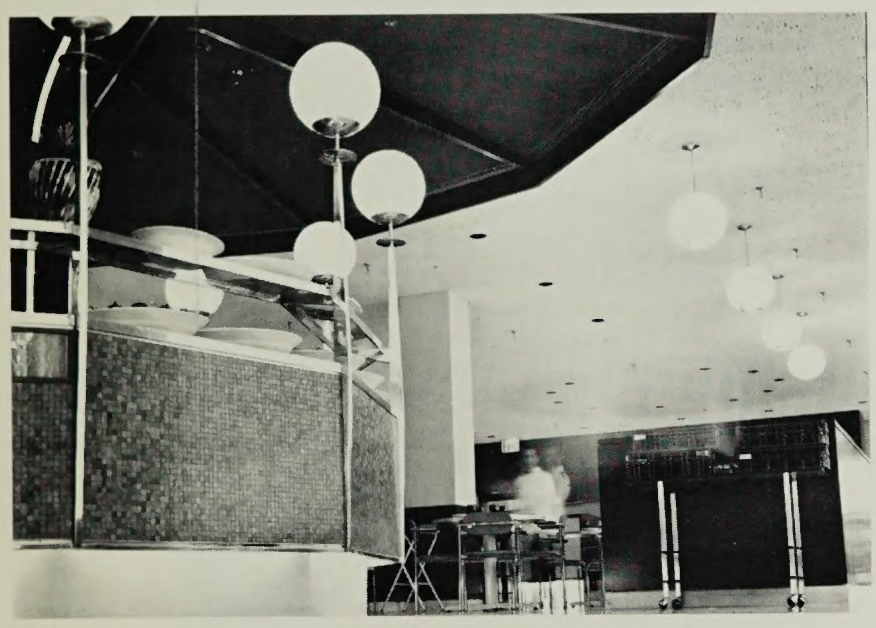
Architect: Kahn & Jacobs
General Contractor: H. R. H. Construction Corp.
Plumbing Contractor: J. L. Murphy
Lead Work: J. F. Abernethy

Pool and Fountain, Constitution Plaza, Hartford, Connecticut.

Architect: Charles DuBose
General Conractor: F. H. McGraw
Landscape Architect: Sasaki, Walker & Assoc.
Lead Work: J. F. Albernethy

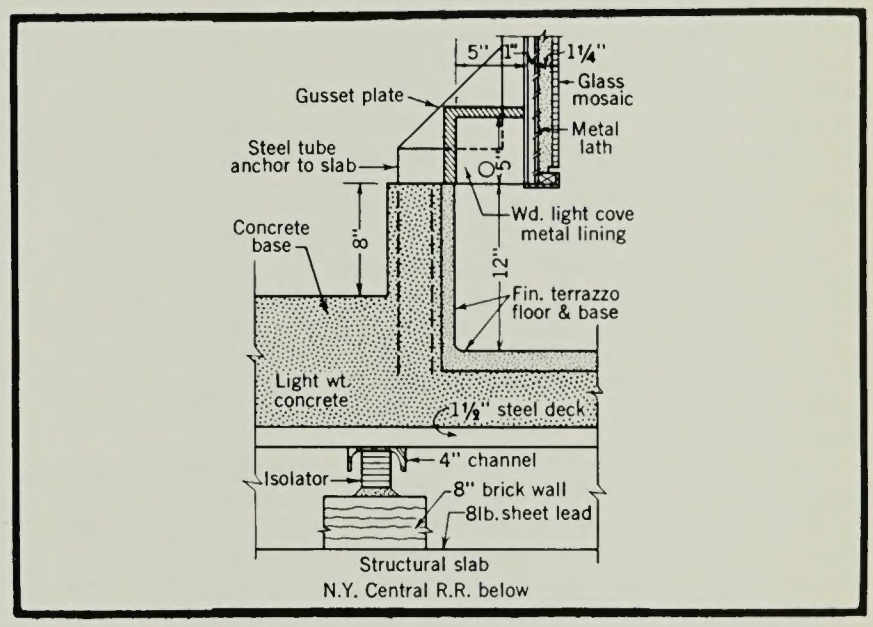




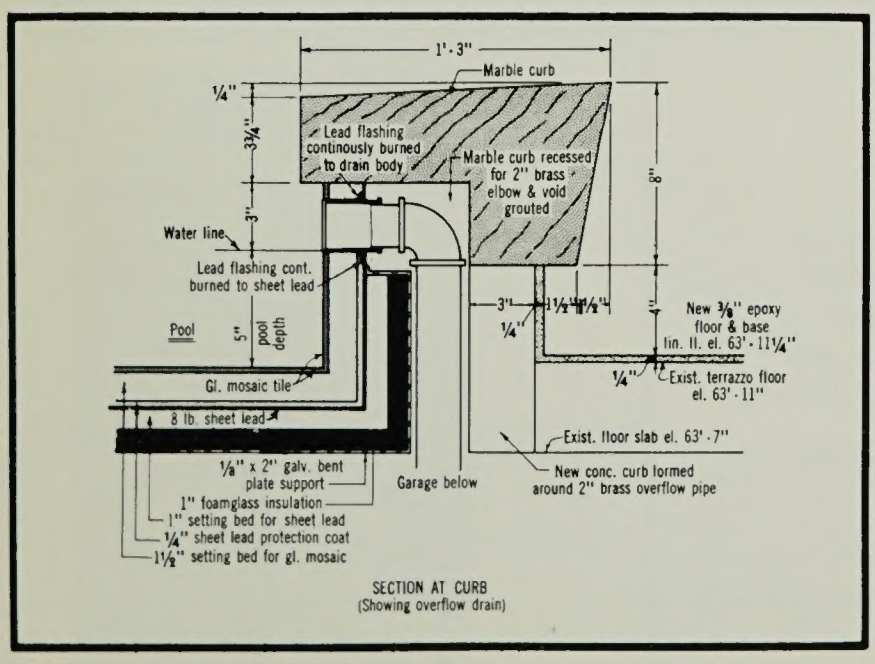


Detail at "Gazebo" bar

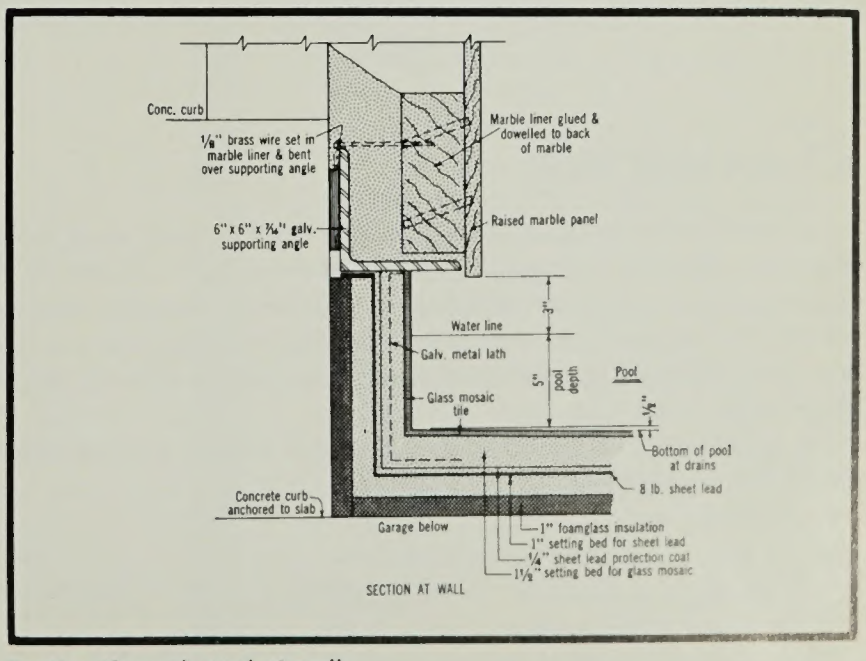
Designers: Restaurant Associates
Architects: Emery Roth & Sons
General Contractor: Diesel Construction Co.
Structural Engineer: James Ruderman
Lead Work: J. F. Abernethy



Detail section through curb at "Gazebo" bar



Section through pool at curb



Section through pool at wall

ROOFS, MEMBRANE TYPE:

American Electric Power Company

An increasing number of installations of sheet lead membrane are appearing which partake of the problems to be found in pools and planters over occupied areas but which have additional factors peculiarly their own. These are the purely rooftop membrane types such as the landscaped and terraced rooftop over the Computer Center for the American Electric Power System in Canton, Ohio. This Center will achieve not only automatic, minute-by-minute control of a seven-state electric power network but will include facilities to centralize its accounting and billing operations. The result of stoppage of an operation of this magnitude would be severe. The importance of continuous service justifies a completely impervious shield of lead across the entire structure.

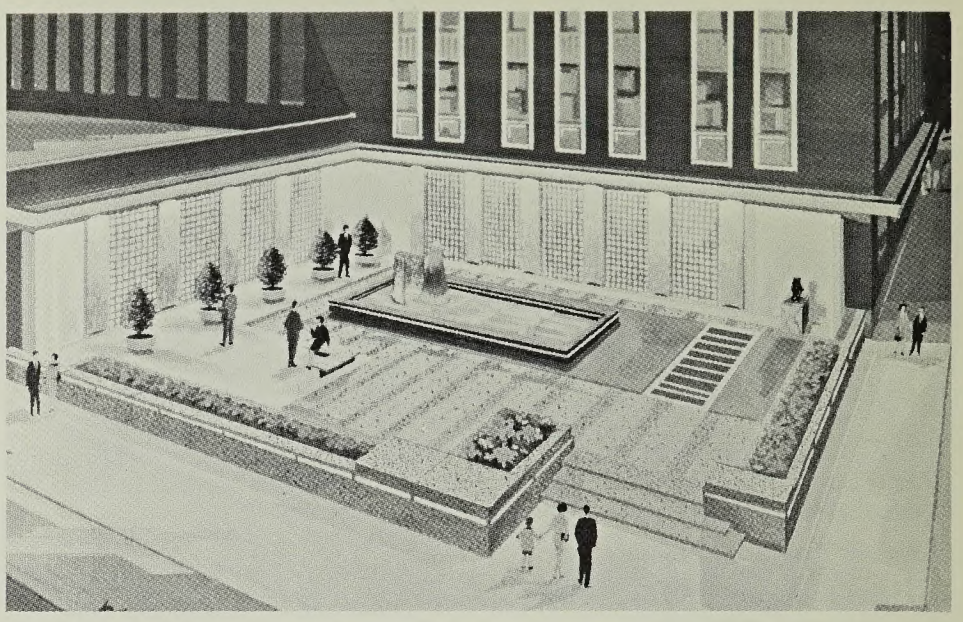
Usually 6-lb or 8-lb sheet lead is used as the basic membrane and is underlaid by 30-lb asphalt impregnated felt over whatever fill, insulation, vapor barriers, etc., have been specified. A heavy coat of asphaltum on top of the lead membrane after sheets have been lapped a minimum of 1 inch at joints and "burned" (welded), will protect the lead against free lime in fresh mortar, slabs, stonework or other finishing material finally placed.

In addition, installations of this size and scope require certain simple precautions in scheduling and detailing. Careful scheduling will insure that installation of finishing materials follows completion of lead work within a reasonable period. As installation proceeds, ½ inch insulation board should be placed over the finished work to provide temporary mechanical protection against damage by other trades and thermal protection against excessive temperature changes until finishing materials have been installed.

Since coverage of the roof surface is total, penetrations of various kinds through the membrane will be correspondingly more frequent. Careful detailing will provide protection for these in the form of a lead boot or sleeve which is burned to the membrane and burned, soldered or clamped to the pipe or other item to be flashed. This boot or sleeve should be brought to the same height as the upstand of the membrane at any point elsewhere on the roof.

Subsurface, as well as surface, drainage should be provided to conduct into the drainage system any water trapped between the finished surface and the top of the lead. This is usually accomplished by pitching the fill under the lead membrane a minimum of ⅛-in. to the foot toward the drain. At the drain weepholes should be provided just above the surface of the lead. If a clamping ring is used, make sure the portion of lead to be placed in the ring also has a standard brush coat of asphaltum to protect it. This is of the utmost importance to protect against concentration of free lime at these points.

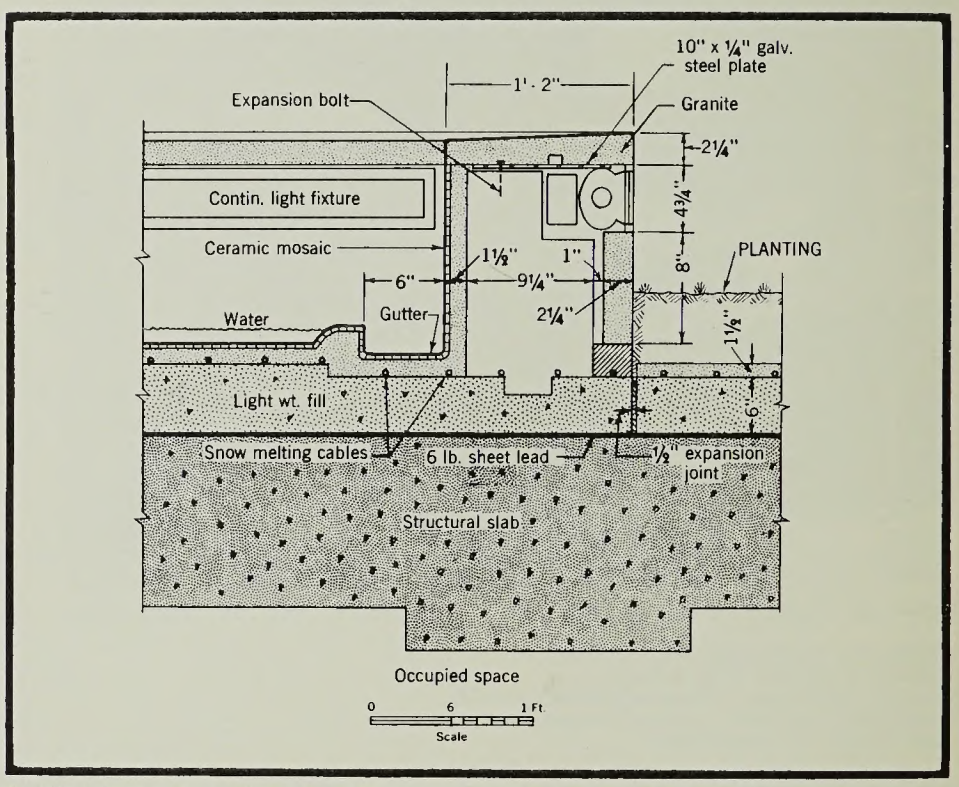
Detail sections show placement of membrane with respect to fill and finish and the treatment of pool and plant box. Details of drainage treatment may be found on page 7.



Architects rendering of landscaped terrace over below grade computer center

American Electric Power System, Canton, Ohio

Architects: Staff Architect
General Contractor: Theodore Bogner
Lead Work: Knapp Mills, N.Y.



Section through pool at plant box

FLOORING:

A unique use for sheet lead, and one finding favor as a decorative, as well as water resistant material, is its use as flooring in ski rooms, "mud rooms", powder rooms, small private bars or domestic laundry rooms. Sheet lead in 4-lb weight is usually specified and can be fastened to a marine plywood subfloor by means of copper or brass round headed nails in decorative designs or patterns.

An occasional mopping will clean such a floor and no other preparation, treatment or maintenance is necessary.

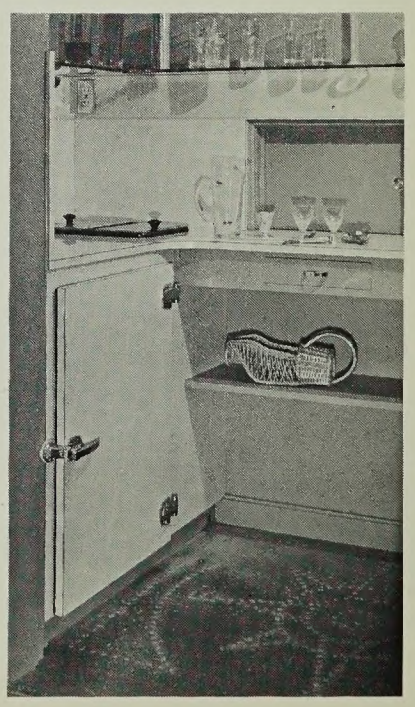


Photo shows use of 4 lb sheet lead floor fastened with copper nails outlining a decorative compass rose

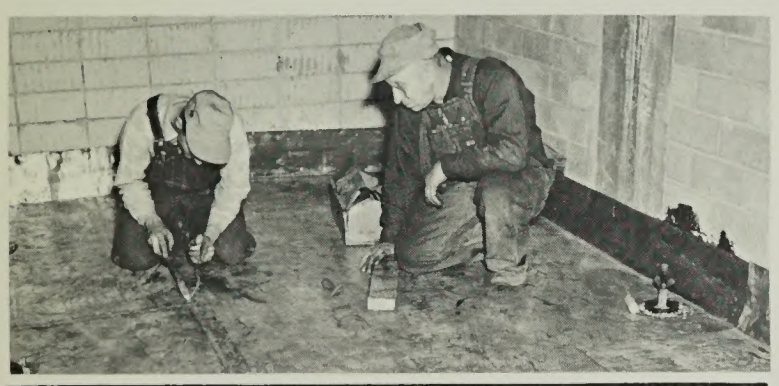
Stone Residence, Milwaukee, Wisconsin
Architect: Perry, Shaw & Hepburn

AVERY CLASSICS

STALL SHOWERS and SHOWER ROOMS: Des Moines YMCA

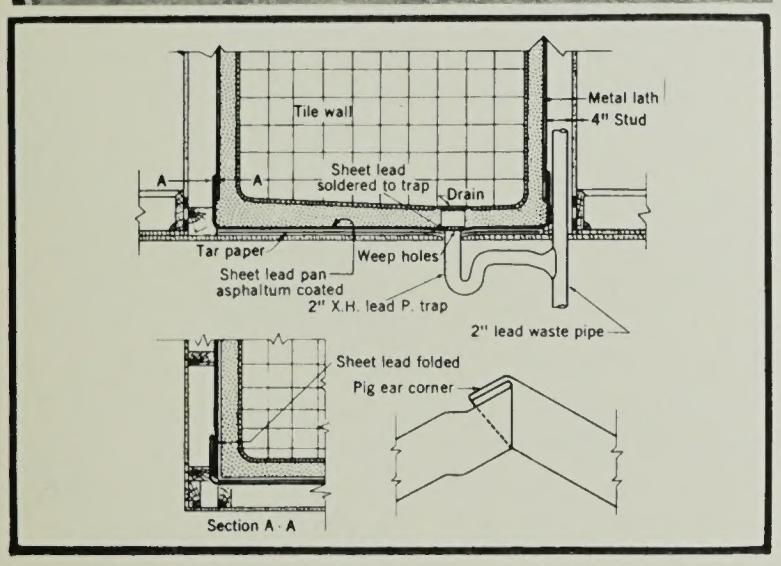
The unquestioned increase in recent years in public preference for a shower rather than a bath has led to its exclusive use in some installations and sharply increased use in others. Since most, if not all of these fixtures, are over occupied areas, provision must be made to completely waterproof each installation. Whether used in the home or in dormitories, athletic clubs, apartments or public bathing facilities, the most positive, timetested and easily used waterproofing known is the lead shower pan.

A typical shower room installation for the Des Moines, YMCA is shown in the photograph. A total of 5,883 square feet of 4-lb sheet lead was used with 4-in. upstands at walls. In this case sheets were lapped 1-in. and soldered. A typical detail shows proper installation and three types of waste connections are illustrated. Specifications follow:



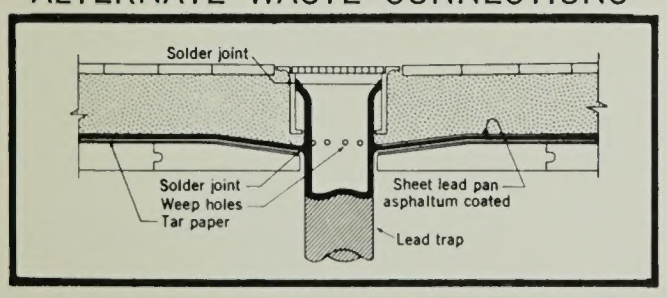
Soldering 4 lb sheet lead waterproofing. Note double drainage shower traps with clamping rings.

Architect: Wetherell & Harrison
Lead Work: A. J. Allen Plumbing & Heating Co.



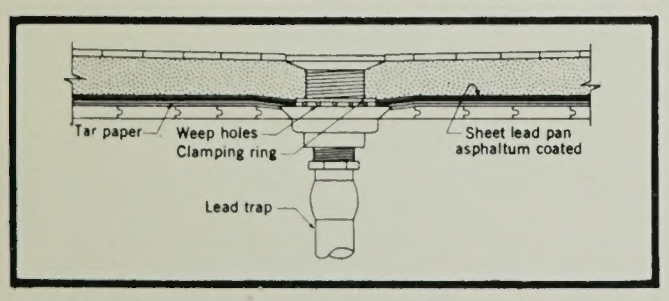
SHEET LEAD SHOWER PAN

ALTERNATE WASTE CONNECTIONS



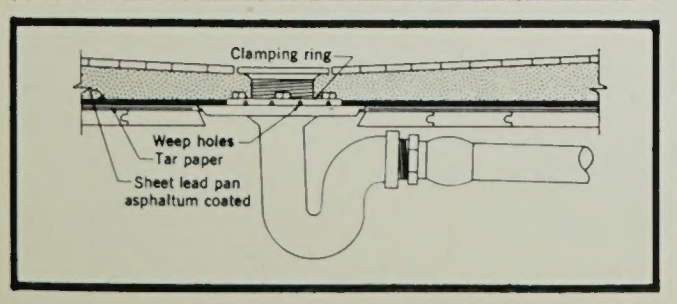
A

To lead trap



B

To lead trap and clamping ring



C

To cast-iron double drainage shower trap

LEAD SHOWER AND SAFE PANS

Specifications

Sheet lead for shower (safe) pans shall be in accordance with ASTM Specifications B-29.

Shower stall (room) floors (. . . . . .) shall be completely lined with 4 lb. (6 lb., 8 lb.) sheet lead pans turned at least 6 in. up the side walls all around or at least 1 in. above the finished floor. Corners of pans shall be folded tightly against the upstand (and soldered [welded] along the top). (Corners of pans shall be a lap joint prepared by lapping one side of the upstand over the other at least ½ in. and soldering [welding] the vertical seam.)

Top of upstands shall be set back ¼ in. into notches in studs. (Top of upstands shall be dressed tightly against masonry walls.) In rooms too large to be covered by a single sheet of lead, seams joining sheets shall be lapped at least ½ in. in direction of flow and soldered (welded), with solder sweated between the sheets to the width of the overlap. Pipe or structural members protruding through the lead pan shall be flashed with lead boots or sleeves extending to a height equal to the upstand and be soldered (welded) to the pan. Concrete under pans shall be brought to a smooth finish with a mixture of cement and sand, then covered with asphalt-impregnated building paper weighing at least 15 lbs. per square with lap-joints asphaltum coated to hold paper in place. (Wood floors under pans shall be firm and even with nail heads set, and made of well-seasoned ⅞-in. boards covered with asphalt-impregnated building paper weighing at least 15 lb. per square.) Inside of pans shall be well coated with a good grade of asphaltum. Building paper shall be laid over the inside of lead pans on top of the asphaltum coating if the pans are left uncovered and there is danger of mechanical injury. A cement and sand mixture shall be used inside pans as foundation for tile. Pans shall be graded to the floor drain to which they shall be securely soldered (welded) (clamped). The trap flange shall be countersunk and weep holes provided in the drain just above the lead pan. The trap shall be plugged and pan filled with water as a test before installing the cement and tile.

SPECIFICATIONS

FOR POOLS AND OTHER MEMBRANE WATERPROOFING

GENERAL: The Contractor shall read the general conditions and special conditions of the General Specifications which are hereby made a part of this specification and shall be binding as if repeated in this section.

SCOPE OF THE WORK: This section of the Specification is intended to cover all lead sheet metal work in connection with the installation of a complete lead membrane as detailed and as may be required to complete a sound, durable and watertight job. This Contractor shall supply all labor, materials and tools and equipment necessary to complete the work in accordance with this Specification.

MATERIALS: Unless otherwise noted, sheet lead shall weigh not less than 4 lb. (6 lb.)-(8 lb.)-per square foot and be made from lead meeting ASTM Specification #B29-55, Pig Lead.

a) All portions of new concrete slabs or other masonry surfaces over which lead is to be laid shall be covered with 30 lb. asphalt impregnated felt.

—or—

b) Lower surface of lead to be in contact with new concrete slabs or other masonry surfaces shall be protected with a heavy brush coat of black asphaltum as made by. . . . . .

Where fresh or green cement is to be placed over lead, the upper surface of the lead sheet shall be protected by a heavy brush coat of black asphaltum as made by. . . . . .

EXAMINATION OF SURFACES: If defects are found in surfaces upon which this contractor's work is to be placed, he shall report them to the architect who shall cause them to be remedied. Starting of work shall constitute acceptance of such surfaces.

PREPARATION OF SURFACES: All surfaces to receive lead shall be smooth and even, free from sharp projections. Concrete shall be screeded and floated to a smooth surface without projecting stones or other aggregate. Brick or other masonry surfaces against which lead is to be laid shall be true and straight with joints struck flush or tooled with half round tool. Any angle or edge over which lead must be turned shall be chamfered or eased. All surfaces to receive lead shall be dry, sound and clean when lead is laid.

JOINTS: All joints shall be lapped joints and burned*. Sheets shall be lapped one inch minimum before burning. All burning rod shall be of the same composition as sheet lead to be burned. All sections of lead that are to become a part of the joint shall be perfectly cleaned by a shave hook or wire brush. Only the smallest sizes of tips shall be used on the burning torch and extreme care shall be taken to avoid burning through or reducing the thickness of the lead sheet being joined.

*Lead "burning" is trade terminology for a true weld. Burning is preferred over soldering

—or—

All joints shall be lapped and soldered. Before soldering all areas to be soldered, including the underside of the overlapping sheet and the area of the bottom sheet directly under the lap and extending at least ¼ inch beyond the edge of the lap, shall be shaved clean with a shave hook after which plumbers candle should be rubbed immediately over all shaved parts in a very thin coat to prevent oxidation. Powdered rosin shall be sprinkled over all shaved areas. After sheets have been solder tacked together at suitable intervals, 50-50 solder shall be fed to the joint by a clean, well tinned soldering iron at the proper temperature.

LAYING AND WORKMANSHIP: All tools, brakes, tongs, etc. shall be adjusted to bend and work lead to easy curves and to prevent scoring or bruising the material. Use mallet or wood dresser in place of hammer where possible. Allow room for expansion between rigid members.

LEAD PROTECTION: This Contractor shall protect his material and work in place from damage by his or other workmen and shall be responsible for and shall repair any damage which may occur before final completion. As installation proceeds, ½-in. insulation board shall be placed over the finished work to provide temporary mechanical protection against damage by other trades and thermal protection against excessive temperature changes until finishing materials have been installed. All work shall be left in completed condition, sound and clean.

TEST AND INSPECTION: A hydrostatic test, satisfactory to the architect, shall be required for a period of twenty-four hours prior to final inspection and acceptance.

ARCHITECTURAL DEPARTMENT
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